

WHAT IS CLAIMED IS:

1. A method of signaling bearer connection on Iu interface for MBMS service, wherein RNC establishes the shared signaling bearer for MBMS service on Iu interface, comprising the steps of:

(a) RNC receives a MBMS Notification message for a certain MBMS service from SGSN;

(b) RNC constructs a MBMS Service Request message according to the contents of the notification;

(c) RNC sends a SCCP Connection Request message to SGSN, requests to establish a SCCP signaling connection, and then waits for a reply;

(d) RNC receives a SCCP Connection Confirmation message from SGSN, which indicates the success of the Iu signaling connection establishment used for this service.

2. The method as claimed in Claim 1, wherein the following situation is added to the conditions of the existing SCCP connection establishment initiated by RNC: when RNC sends a MBMS Service Request message, if there is no corresponding Iu signaling connection for this service, RNC initiates a SCCP connection establishment procedure.

3. The method as claimed in Claim 1, wherein further comprising: if a certain UE needs to receive other non-MBMS service besides MBMS service or it has moved, RNC needs to establish a dedicated Iu connection for the UE, which includes the following steps:

(a) SRNC decides to execute relocation procedure;

(b) SRNC constructs a Relocation Demand message and checks whether there is a Iu signaling connection for this UE; if it is absent, a SCCP Connection Request message which includes a Relocation Demand message in its data field is constructed;

(c) SRNC sends a SCCP Connection Request message to SGSN, requests to establish a SCCP signaling connection, and then waits for a reply;

(d) SRNC receives a SCCP Connection Confirmation message from SGSN, which indicates the success of the Iu signaling connection establishment used for this service.

4. The method as claimed in Claim 1, wherein further comprising: if a certain UE needs to receive other non-MBMS service besides MBMS service or it has moved,

SGSN needs to establish a dedicated Iu connection for the UE, which includes the following steps:

(a) after receiving a SCCP Connection Request message from RNC, SGSN separates the RANAP message included in the data fields, if the RANAP message is a Relocation Demand message, it save the Iu signaling connection ID allocated by RNC for this UE, allocates the identifier of the signaling connection in SGSN, and constructs a SCCP Connection Confirmation message;

(b) SGSN sends a SCCP Connection Confirmation message to RNC;

(c) SGSN sends a Relocation Request message to the new SGSN;

(d) after receiving a Relocation Response message from the new SGSN, the SGSN sends a Relocation Command message to RNC via the dedicated Iu signaling connection for the UE.

5. The method as claimed in Claim 1, wherein further comprising: if a certain UE needs to receive other non-MBMS service besides MBMS service or it has moved, RNC needs to establish a dedicated Iu connection for the UE, which includes the following steps:

(a) when RNC receives a non-MAC message Service Request from UE, it examines whether there is a dedicated Iu connection for the UE, if it is absent, a SCCP Connection Request message is constructed and a SCCP connection establishment procedure is initiated while forwarding the Service Request message to SGSN, RNC sends the SCCP Connection Request message to SGSN and then waits for a reply;

(b) if RNC receives a SCCP Connection Confirmation message from SGSN, it indicates that the dedicated Iu signaling connection for this UE has been successfully established.

6. The method as claimed in Claim 1, wherein further comprising: if a certain UE needs to receive other non-MBMS service besides MBMS service or it has moved, SGSN needs to establish a dedicated Iu connection for the UE, which includes the following steps:

(a) after receiving a SCCP Connection Request message from RNC, SGSN separates the RANAP message included in the data fields, if the RANAP message is a Service Request message, it saves the Iu signaling connection ID allocated by RNC for this UE, allocates the identifier of the signaling connection in SGSN, and constructs a SCCP Connection Confirmation message;

(b) SGSN sends a SCCP Connection Confirmation message to RNC;

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(c) if the service request is accepted, the SGSN returns back a Service Acceptance message to MS and sends a Establish RAB message via this dedicated connection.

5 7. The method as claimed in Claim 1, wherein further comprising: in the SRNS relocation flow, if the target RNC is not incorporated with a certain MBMS service necessary for the UE after receiving a Relocation Request message, it sends a MBMS Service Request message to SGSN, thus, During the next step (607, 707, 807), RAB establishment procedure can also establish RAB for the MBMS service.

10 8. The method as claimed in Claim 1, wherein for the shared MBMS Iu signaling connection, when there is no UE using a certain MBMS service between RNC and SGSN, RNC can initiate a Iu connection release procedure.

15 9. The method as claimed in Claim 1, wherein for the shared MBMS Iu signaling connection, SGSN can initiate a release procedure in the following two situations:

 when SGSN won't receive MBMS data any more, a signaling connection and RAB release procedure can be initiated;

 when no UE uses a certain MBMS service between RNC and SGSN, SGSN can initiate a Iu connection release procedure.

20 10: A method of signaling bearer connection on Iu interface for MBMS service, wherein SGSN establishes the shared signaling bearer for MBMS service, the method includes the following steps:

25 (a) SGSN sends a MBMS Notification message to Radio Network Controller (RNC) after receiving the data sent from GGSN, notifies of relevant MBMS service information, and then waits for the response message from RNC;

30 (b) after receiving a SCCP Connection Request message from RNC, SGSN separates the RANAP message included in the data fields and saves the Iu signaling connection ID allocated by RNC for this service, allocates the identifier of the signaling connection in SGSN, and constructs a SCCP Connection Confirmation message and a MBMS RAB Assignment Request message;

 (c) SGSN sends a SCCP Connection Confirmation message to RNC;

35 (d) SGSN sends a MBMS RAB Assignment Request message to RNC via the shared Iu connection established, if the MBMS RAB Assignment Request message is included in the data field of the SCCP Connection Confirmation message, this step can be omitted.

11. The method as claimed in Claim 10, wherein further comprising: if a certain UE needs to receive other non-MBMS service besides MBMS service or it has moved, RNC needs to establish a dedicated Iu connection for the UE, which includes the following steps:

(a) SRNC decides to execute a relocation procedure;

(b) SRNC constructs a Relocation Demand message and checks whether there is a Iu signaling connection for this UE; if it is absent, a SCCP Connection Request message, which includes a Relocation Demand message in its data field, is constructed;

(c) SRNC sends a SCCP Connection Request message to SGSN, requests to establish a SCCP signaling connection, and then waits for a reply;

(d) SRNC receives a SCCP Connection Confirmation message from SGSN, which indicates the success of the shared Iu signaling connection establishment used for this service.

12. The method as claimed in Claim 10, wherein further comprising: if a certain UE needs to receive other non-MBMS service besides MBMS service or it has moved, SGSN needs to establish a dedicated Iu connection for the UE, which includes the following steps:

(a) after receiving a SCCP Connection Request message from RNC, SGSN separates the RANAP message included in the data fields, if the RANAP message is a Relocation Demand message, it saves the Iu signaling connection ID allocated by RNC for this service, allocates the identifier of the signaling connection in SGSN, and constructs a SCCP Connection Confirmation message;

(b) SGSN sends the SCCP Connection Confirmation message to RNC;

(c) SGSN sends a Relocation Request message to the new SGSN;

(d) After receiving a Relocation Response message from the new SGSN, SGSN sends a Relocation Command message to RNC via the dedicated Iu signaling connection for UE.

13. The method as claimed in Claim 10, wherein further comprising: if a certain UE needs to receive other non-MBMS service besides MBMS service or it has moved, RNC needs to establish a dedicated Iu connection for the UE, which includes the following steps:

(a) when RNC receives a non-MAC message Service Request from UE, it examines whether there is a dedicated Iu connection for the UE, if it is absent, the RNC constructs

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a SCCP Connection Request message, initiates a SCCP connection establishment procedure while forwarding the Service Request message to SGSN, RNC sends the SCCP Connection Request message to SGSN and then waits for a reply;

(b) if RNC receives a SCCP Connection Confirmation message from SGSN, it indicates that the dedicated Iu signaling connection for this UE has been successfully established.

14. The method as claimed in Claim 10, wherein further comprising: if a certain UE needs to receive other non-MBMS service besides MBMS service or it has moved, SGSN needs to establish a dedicated Iu connection for the UE, which includes the following steps:

(a) after receiving a SCCP Connection Request message from RNC, SGSN separates the RANAP message included in the data fields, if the RANAP message is a Service Request message, it saves the Iu signaling connection ID allocated by RNC for this service, allocates the identifier of the signaling connection in SGSN, and constructs a SCCP Connection Confirmation message;

(b) SGSN sends a SCCP Connection Confirmation message to RNC;

(c) if the service request is accepted, the SGSN returns back a Service Acceptance message to MS and sends a Establish RAB message via this dedicated connection.

15. The method as claimed in Claim 10, wherein, in the SRNS relocation flow, if the target RNC is not incorporated with a certain MBMS service necessary for the UE after receiving a Relocation Request message, it sends a MBMS Service Request message to SGSN, thus, During the next step (607, 707, 807), the RAB establishment procedure can also establish RAB for the MBMS service.

16. The method as claimed in Claim 10, wherein for the shared MBMS Iu signaling connection, when there is no UE using a certain MBMS service between RNC and SGSN, RNC can initiate a Iu connection release procedure.

17. The method as claimed in Claim 10, wherein for the shared MBMS Iu signaling connection, SGSN can initiate a release procedure in the following two situations:

when SGSN won't receive MBMS data any more, a signaling connection and RAB release procedure can be initiated;

when no UE uses a certain MBMS service between RNC and SGSN, SGSN can initiate an Iu connection release procedure.

18. A method of signaling bearer connection on Iu interface for MBMS service, in which SGSN establishes the shared signaling bearer for MBMS service on Iu interface, the method, comprising the steps of:

5 (a) SGSN receives MBMS data from GGSN;

(b) SGSN analyzes the on-going service, if there is no shared Iu connection used for this service, it organizes a SCCP Connection Request message, which include a MBMS RAB Assignment Request message in its data field;

10 (c) SGSN sends a SCCP Connection Request to RNC, requests to establish SCCP signaling connection, and then waits for a reply;

(d) SGSN receives a SCCP Connection Confirmation message from RNC, which indicates the success of the shared Iu signaling connection establishment for this service.

15 19. The method as claimed in Claim 18, wherein the following situation is added to the conditions of the existing SCCP connection establishment initiated by SGSN: when SGSN sends a MBMS RAB Assignment Request message, if there is no Iu signaling connection corresponding to this service, the SGSN initiates a SCCP connection establishment procedure, a RANAP message is included in the data field of the SCCP
20 Connection Request message.

25 20. The method as claimed in Claim 18, wherein further comprising: if a certain UE needs to receive other non-MBMS service besides MBMS service or it has moved, RNC needs to establish a dedicated Iu connection for the UE, which includes the following steps:

(a) SRNC decides to execute a relocation procedure;

(b) SRNC constructs a Relocation Demand message and examines whether there is a Iu signaling connection for this UE; if it is absent, a SCCP Connection Request message, which includes a Relocation Demand message in its data field, is constructed;

30 (c) SRNC sends a SCCP Connection Request message to SGSN, requests to establish a SCCP signaling connection, and then waits for a reply;

(d) SRNC receives a SCCP Connection Confirmation message from SGSN, which indicates the success of the shared Iu signaling connection establishment used for this service.

21. The method as claimed in Claim 18, wherein further comprising: if a certain UE needs to receive other non-MBMS service besides MBMS service or it has moved, SGSN needs to establish a dedicated Iu connection for the UE, which includes the following steps:

- a) after receiving a SCCP Connection Request message from RNC, SGSN separates the RANAP message included in the data fields, if the RANAP message is a Relocation Demand message, it saves the Iu signaling connection ID allocated by RNC for this service, allocates the identifier of the signaling connection in SGSN, and constructs a SCCP Connection Confirmation message;
- b) SGSN sends a SCCP Connection Confirmation message to RNC;
- c) SGSN sends a Relocation Request message to the new SGSN;
- d) after receiving a Relocation Response message from the new SGSN, SGSN sends a Relocation Command message to RNC via the dedicated Iu signaling connection for UE.

22. The method as claimed in Claim 18, wherein further comprising: if a certain UE needs to receive other non-MBMS service besides MBMS service or it has moved, RNC needs to establish a dedicated Iu connection for the UE, which includes the following steps:

(a) when RNC receives a non-MAC message Service Request from UE, it checks whether there is a dedicated Iu connection for the UE, if it is absent, RNC constructs a SCCP Connection Request message and initiates a SCCP connection establishment procedure while forwarding the Service Request message to SGSN, RNC sends the SCCP Connection Request message to SGSN and then waits for a reply;

(b) if RNC receives a SCCP Connection Confirmation message from SGSN, it indicates that the dedicated Iu signaling connection for this UE has been successfully established.

23. The method as claimed in Claim 18, wherein further comprising: if a certain UE needs to receive other non-MBMS service besides MBMS service or it has moved, SGSN needs to establish a dedicated Iu connection for the UE, which includes the following steps:

(a) after receiving a SCCP Connection Request message from RNC, SGSN separates the RANAP message included in the data fields, if the RANAP message is a Service Request message, it saves the Iu signaling connection ID allocated by RNC for

this service, allocates the identifier of the signaling connection in SGSN, and constructs a SCCP Connection Confirmation message;

(b) SGSN sends the SCCP Connection Confirmation message to RNC;

(c) if the service request is accepted, the SGSN returns back a Service Acceptance message to MS and sends a Establish RAB message via this dedicated connection.

24. The method as claimed in Claim 18, wherein for the shared MBMS Iu signaling connection, when there is no UE using a certain MBMS service between RNC and SGSN, RNC can initiate a Iu connection release procedure.

25. The method as claimed in Claim 18, wherein for the shared MBMS Iu signaling connection, SGSN can initiate a release procedure in the following two situations:

when SGSN won't receive MBMS data any more, a signaling connection and RAB release procedure can be initiated;

when no UE uses a certain MBMS service between RNC and SGSN, SGSN can initiate a Iu connection release procedure.

26. A method of signaling bearer connection on Iu interface for MBMS service, wherein RNC establishes the shared signaling bearer for MBMS service on Iu interface, includes the following steps:

(a) after receiving a SCCP Connection Request message from SGSN, RNC separates the RANAP message included in the data fields and saves the Iu signaling connection ID allocated by SGSN for this service; and allocates the identifier of the signaling connection in RNC and constructs a SCCP Connection Confirmation message and a MBMS RAB Assignment Response message;

(b) RNC sends a SCCP Connection Confirmation message to SGSN;

(c) RNC sends a MBMS RAB Assignment Response message to SGSN via the shared Iu connection established, if the MBMS RAB Assignment Response message is included in the data field of the SCCP Connection Confirmation message, this step can be omitted.

27. The method as claimed in Claim 26, wherein further comprising: if a certain UE needs to receive other non-MBMS service besides MBMS service or it has moved, RNC needs to establish a dedicated Iu connection for the UE, which includes the following steps:

(a) SRNC decides to execute a relocation procedure;

(b) SRNC constructs a Relocation Demand message and checks whether there is a Iu signaling connection for this UE; if it is absent, a SCCP Connection Request message, which includes a Relocation Demand message in its data field, is constructed;

(c) SRNC sends a SCCP Connection Request message to SGSN, requests to
5 establish a SCCP signaling connection and then waits for a reply;

(d) SRNC receives a SCCP Connection Confirmation message from SGSN, which indicates the success of the shared Iu signaling connection establishment used for this service.

10 28. The method as claimed in Claim 26, wherein further comprising: if a certain UE needs to receive other non-MBMS service besides MBMS service or it has moved, SGSN needs to establish a dedicated Iu connection for the UE, which includes the following steps:

(a) after receiving a SCCP Connection Request message from RNC, SGSN
15 separates the RANAP message included in the data fields; if the RANAP message is a Relocation Demand message, it saves the Iu signaling connection ID allocated by RNC for this service, allocates the identifier of the signaling connection in SGSN, and constructs a SCCP Connection Confirmation message;

(b) SGSN sends a SCCP Connection Confirmation message to RNC;

20 (c) SGSN sends a Relocation Request message to the new SGSN;

(d) after receiving a Relocation Response message from the new SGSN, SGSN sends a Relocation Command message to RNC via the dedicated Iu signaling connection for UE.

25 29. The method as claimed in Claim 28, wherein the following situation is added to the conditions of the existing SCCP connection establishment initiated by RNC: when RNC sends a MBMS Service Demand message, if there is no corresponding Iu signaling connection for this service, RNC initiates a SCCP connection establishment procedure, a RANAP message is included in the data field of the SCCP Connection
30 Request message.

30. The method as claimed in Claim 26, wherein further comprising: if a certain UE needs to receive other non-MBMS service besides MBMS service or it has moved, RNC needs to establish a dedicated Iu connection for the UE, which includes the
35 following steps:

(a) when RNC receives a non-MAC message Service Request from UE, it examines whether there is a dedicated Iu connection for the UE, if it is absent, the RNC constructs

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a SCCP Connection Request message and initiates a SCCP connection establishment procedure while forwarding the Service Request message to SGSN, RNC sends the SCCP Connection Request message to SGSN and then waits for a reply;

(b) if RNC receives a SCCP Connection Confirmation message from SGSN, it indicates that the dedicated Iu signaling connection for this UE has been successfully established.

31. The method as claimed in Claim 26, wherein further comprising: if a certain UE needs to receive other non-MBMS service besides MBMS service or it has moved, SGSN needs to establish a dedicated Iu connection for the UE; which includes the following steps:

(a) after receiving a SCCP Connection Request message from RNC, SGSN separates the RANAP message included in the data fields, if the RANAP message is a Relocation Request message, it saves the Iu signaling connection ID allocated by RNC for this service, allocates the identifier of the signaling connection in SGSN, and constructs a SCCP Connection Confirmation message;

(b) SGSN sends a SCCP Connection Confirmation message to RNC;

(c) If the service request is accepted, the SGSN returns back a Service Acceptance message to MS and sends a Establish RAB message via this dedicated connection.

32. The method as claimed in Claim 27, wherein in SRNS relocation flow, if the source RNC finds that the moving user is the last user for a certain MBMS service between the source RNC and the source SGSN and the shared Iu connection for this service also exists, the source RNC initiates a procedure of releasing the shared Iu connection and the resources on the user plane.

33. The method as claimed in Claim 32, wherein the release procedure is composed by the following three steps:

- RNC sends a Iu Release Request message to SGSN and requests to release the shared Iu signaling connection and the resources on the user plane;
- after receiving a Iu Release Request message from RNC, SGSN sends a Iu Release Command message to the source RNC;
- after receiving the Iu Release Command message from SGSN, the source RNC releases the corresponding resources and sends a Iu Release Completion message to SGSN;

if the UE is the last user of multiple services in the source RNC, the release

procedure needs to be executed for multiple times;

this release scheme is also applicable to the situation when the last UE that uses a certain MBMS service between RNC and SGSN quits the service.

5 34. The method as claimed in Claim 32, wherein the release procedure is initiated by RNC, if the source RNC finds that the last UE that uses MBMS service has left or
quitted the service, RNC releases the user plane resources and Iu connection, and then
sends a MBMS Iu Release Indication message to the old SGSN, if the UE is the last
10 user of multiple services in the source RNC, the release procedure needs to be executed
for multiple times.

15 35. The method as claimed in Claim 34, wherein the MBMS Iu Release Indication message is a connection-oriented message, and the message includes RABs Data Volume Report List and released RABs list.

20 36. The method as claimed in Claim 27, wherein in the SRNS relocation flow, if SGSN finds that the last UE that uses MBMS service between it and RNC has left or
quitted the service and there still exists a shared Iu connection for this service, SGSN
initiates a release procedure of the shared Iu connection:

- 25 - SGSN re-sends a Iu Release Command message to RNC and requests to release the shared Iu signaling connection and the resources on the user plane;
- after receiving the Iu Release Command message, the source RNC releases the corresponding resources and sends a Iu Release completion message to SGSN;
- if the UE is the last user of multiple services in the source RNC, the release
25 procedure needs to be executed for several times.

30 37. The method as claimed in Claim 26, wherein for the shared MBMS Iu signaling connection, when there is no UE using a certain MBMS service between RNC and SGSN, RNC can initiate a Iu connection release procedure.

35 38. The method as claimed in Claim 26, wherein for the shared MBMS Iu signaling connection, SGSN can initiate a release procedure in the following two situations:

- when SGSN won't receive MBMS data any more, a signaling connection and RAB release procedure can be initiated;
- when no UE uses a certain MBMS service between RNC and SGSN, both RNC and SGSN initiates an Iu connection release procedure.